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Exploring the Performance Impact of Multi Protocol LABEL Switching Network over Conventional IP Network on the basis of Voice and TEXT

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Abstract

Multi protocol Label Switching (MPLS) is considered to be latest technology to improve the speed performance and efficiency of network along with its QoS (Service Quality for congestion of network) and their scalability. The research article proposed here the benefits of multi protocol label switching to the traditional data network on the concept of ns2 simulator. This switching is basically used for combining the best features of Layer 3 along with Layer 2 of Open System Interconnection model of the network. In this switching the packets are transmitted on the basis of label. Multi protocol Label Switching also facilitates the quick rerouting technique and traffic reengineering. This research article proposes that Multi protocol Label Switching behaves much matured and performs much efficiently than traditional switching when tested on some important parameters.

Keywords: ns2, Multi protocol Label Switching, File transfer protocol, Internet telephony, IP.

1.Introduction

MPLS termed as Multi-Protocol label switching introduced by IETF. MPLS refers to the group of packet switching network and basically designed for gain control to the drawback of conventional IP forwarding [2]. There is a several drawbacks in Conventional IP network that every node must take a decision based on nondependent routing for every packet that arrives, this task increases the network complexity. IP network doesn’t take into consideration the constraints of capacity and also does not consider the traffic characteristics so that congestion increases in the network. Each router of Conventional network should examine each packet to identify the subsequent intermediary node or hop which a packet should adopt to reach to its destination address. There is a poor support of traffic engineering in this network. MPLS overcome the all such drawbacks it supports the concept of traffic engineering also the routing decision is very simple i.e. in MPLS only edge

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routers fully process each packet and also it uses the label for forwarding it. The label switches inside the internetwork just forwards each and every packet on the basis of its label. This reduced delay is measured in traditional routed network which performs standard Internet Protocol routing. Multi-Protocol label switching is a mechanism between layer 3 and 2 of **Open System Interconnection** model [3].

2.Overview of MPLS Architecture

The MPLS header contains the four fields which are demonstrated below:

Label (20 bits)	COS (3 bits)	S (1 bit)	TTL (8 bits)

Figure 1: MPLS Header Format

- **LABEL:** The actual count of MPLS label is in label field which is of 20 bits.
- **SERVICE CLASS (COS):** COS is a three bits field, it affects discarding algorithm and queuing algo that is performed against each packet when it is sent to the internetwork.
- **STACK FIELD (S):** It is a one bit block supports a label stack in a hierarchical manner. Packet with empty label stack is treated as unlabeled packet. Bottom level packet is labeled as label 1.
- **TIME TO LIVE (TTL):** It provides the conventional IPv4 time to live functionality. Packet is considered to be dropped when the value of time to live field is decremented to 0 by the intermediary routers. TTL restricts the packet to unnecessary loop inside the network and hence wasting the useful resources such as bandwidth. Any packet that contain label if traverses in a LSR the time to live value is reduced by one [4].

Multi-Protocol label switching has two main parts known as Data Plane and Control Plane. The data plane is responsible for FIB & LFIB i.e., Forwarding Information Base and Label Forwarding Information Base, whereas the control plane is supervises the internetworking routing protocols such as RIB and LIB, i.e. Routing information Base and Label information base. All the routing decisions are made by RSVP and LDP i.e. Resource Reservation protocol and Label Distribution Protocol along with CRLDP i.e. Constrained Based Label Distribution Protocol. A LDP is a group of procedures through which single LSR reciprocates other LSR for the binding of label made by him [1]. The MPLS domain is created via Label Switch Routers (LSRs) and Labeled Edge Routers (LERs). The starting labeled edge routing node of MPLS is called as Ingress node and the last labeled edge routing node of Multi-Protocol label switching is termed as Egress node. The node between the Multi-Protocol label switching domain is called as LSR i.e. Label Switch Routers [5].

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3.Proposed Work

This research proposed an environment to identify and calculate the impact and cause of Multi-Protocol label switching mechanism onto the voice and text then compare it with conventional network. The parameter used in this research is Average throughput, total number of packet loss and packet loss rate. The design used in this research includes 12 nodes which are treated as network. Two minor tests are performed on both the internetwork with the help of two applications. Firstly the same subtest with same application has been applied over conventional network, after that imposed the MPLS technology and then again performs the same subtest with same application and measures the average throughput, total number of packet received and packet loss rate to identify and calculate the impact and cause of Multi-Protocol label switching mechanism over conventional internetwork.

4.Simulation Tool

ns2 i.e. network simulator version 2 is used for this research which is open source software, freely available on the internet. It came out in 1989.It is considered to be events driving simulation tool that provides parametric support and help for the simulation of protocols like transmission control protocol and user datagram protocol there by providing routing and multicast protocol over cable wire internetwork and non wired internetwork. It helps to analyze the dynamic nature of communication network. Basically provide the way for specifying protocols and simulating their corresponding behavior. For the reason of flexibity and modular nature of NS2 it gains a big popularity in the field of networking research.

4.1 Ns2 Architecture

The ns2 is an event driven discrete simulator on network which primarily focuses on packet simulation of internetworking protocol network (IP). The network simulator project is a part of the VINT project i.e. Virtual Inter Network Test bed which develop and generate various tools in the research of network simulation field. The simulator consists of two main programming languages, OTcL and C++. Both these languages are linked using TCL command language (TclCL). C++ specifies working behavior and back end of the simulation where as OTcL defines the front end configuration and assembly of the objects along with the event scheduling. The following figure shows the architecture of ns2.

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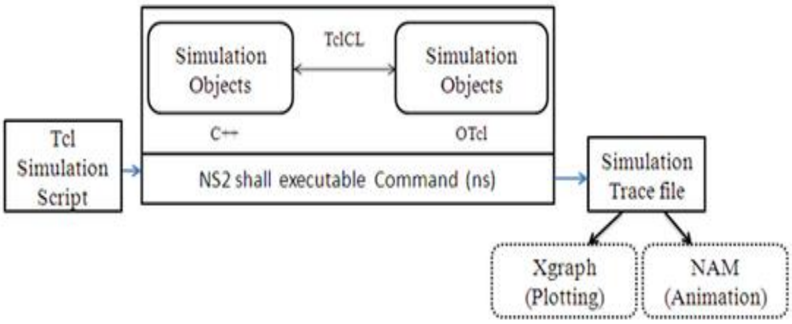

Figure 2: Architecture of network simulator (ns2)

5. Network Topology

The network topology used in the following proposed work is shown below in figure. In conventional network all communicating channels are established in full duplex manner having a propagation latency of 10 mile seconds, it also use a drop tail queuing system that treats each packet on a FCFS i.e. first arrived first treated basis. While applying the Multi-Protocol label switching mechanism every links are configured as duplex-rsvp with the same propagation delay i.e. 10 mile seconds. Two types of bandwidth are set, some links are set to 2 mbps and some are set to 4 mbps as shown in figure 3. All the settings of simulation scenario are randomly chosen.

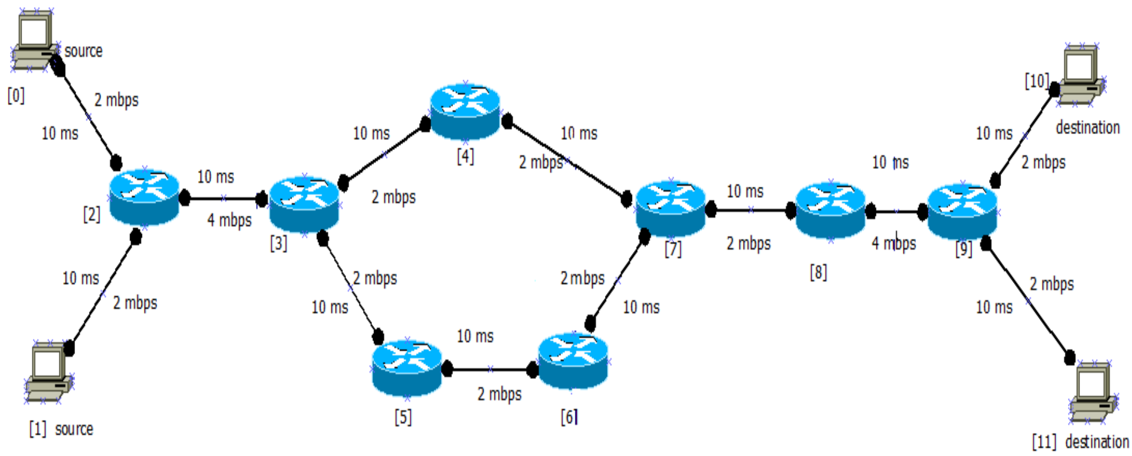

Figure 3: Proposed Simulation Topology

6.Results

6.1 For simulation of voice

In the performed proposed work the voice traffic is simulated using the traffic generator (POO Traffic i.e. Pareto on/off traffic generator) which is integrated in the OTcL command language class commonly considered as Object oriented Tool application for traffic generation in network simulator version 2. The important point which is to be noted here is that all the traffic is generated on random basis.

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All the packets are transmitted on Pareto ON period at a constant same rate and also no packet is transmitted on Pareto OFF period. With the help of Pareto distribution both on and off times are taken. Here, 2 Pareto generators of traffic are used on 2 UDP connections. The source of first Pareto traffic generator is fixed with node labeled 0 i.e. node0 against its destination is currently set to node11 whereas the source of second Pareto traffic generator is fixed with node labeled 1 i.e. node1 against its destination is currently set to node10.

The performance and efficiency of Conventional internetwork and the Multi-Protocol label switching network in voice scenario is shown in figure 4 and figure 5. On the basis of Average throughput, Multi-Protocol label switching network proves better optimization and efficient than conventional internetwork because of the functionality of Multi-Protocol label switching network to utilize each and every route which move towards destination. Conventional network reached its steady state when the route (2_3_4_7_8_9) is saturated and after that it starts to drop the packet whereas the Multi-Protocol label switching network arrived to its steady state when both the paths (2_3_5_6_7_8_9) and (2_3_4_7_8_9) are saturated and hence MPLS performs better while comparing it to conventional network. Packet loss rate for Multi-Protocol label switching internetwork and conventional internetwork for voice is shown in table 1.

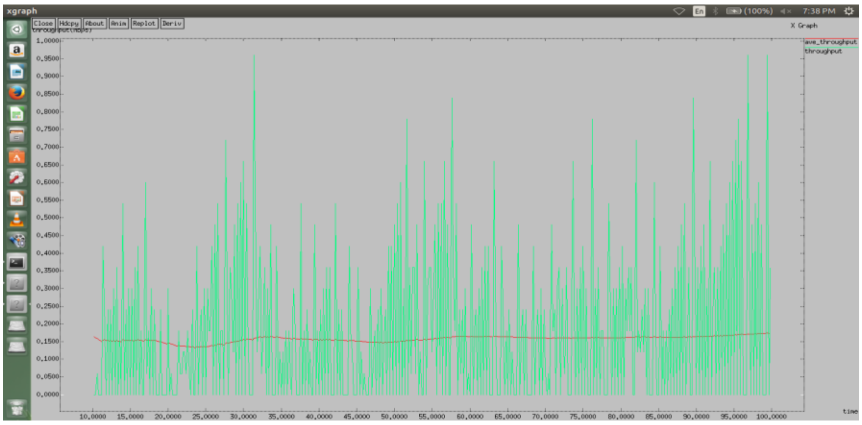

Figure 4: The performance of conventional networks in voice scenario

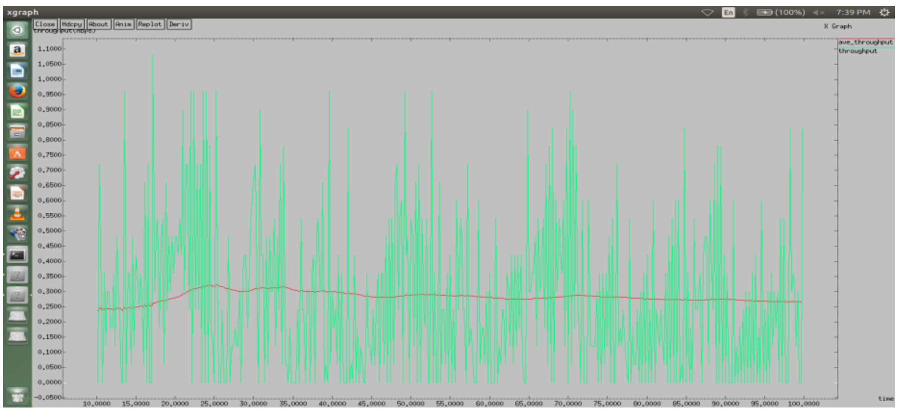

Figure5: The performance of Multi-Protocol label switching networks in same scenario

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Table 1: Packet loss rate for conventional network and MPLS network in voice scenario

Network Type	IP	MPLS
Simulation Time	20 seconds	20 seconds
Total no. of packets transmitted	20362	26630
Total no. of packets received	19582	26100
Total no. of packets dropped	780	530
Packet Loss Rate	3.83	1.99

6.2 For Simulating the Text:

In this research, for evaluating the impact of MPLS and Conventional network over the text, two file transfer protocol packet generators are used on two different transmission control protocol communicating channels. All the traffics are generated randomly. The source of first FTP traffic generator is fixed with node labeled 0 i.e. node0 against its destination is currently set to node11 whereas the source of second FTP traffic generator is fixed with node labeled 1 i.e. node1 against its destination is currently set to node10.

The performance and efficiency of Conventional internetwork and the Multi-Protocol label switching network in text scenario is shown in figure 6 and figure 7. On the basis of Average throughput, Multi-Protocol label switching network proves better optimization and efficient than conventional internetwork because of the functionality of Multi-Protocol label switching network to utilize each and every route which move towards destination.

Conventional network reached its steady state when the route (2_3_4_7_8_9) is saturated and after that it starts to drop the packet whereas the Multi-Protocol label switching network arrived to its steady state when both the paths (2_3_5_6_7_8_9) and (2_3_4_7_8_9) are saturated and hence MPLS performs better while comparing it to conventional network. Packet loss rate for Multi-Protocol label switching internetwork and conventional internetwork for voice is shown in table 2

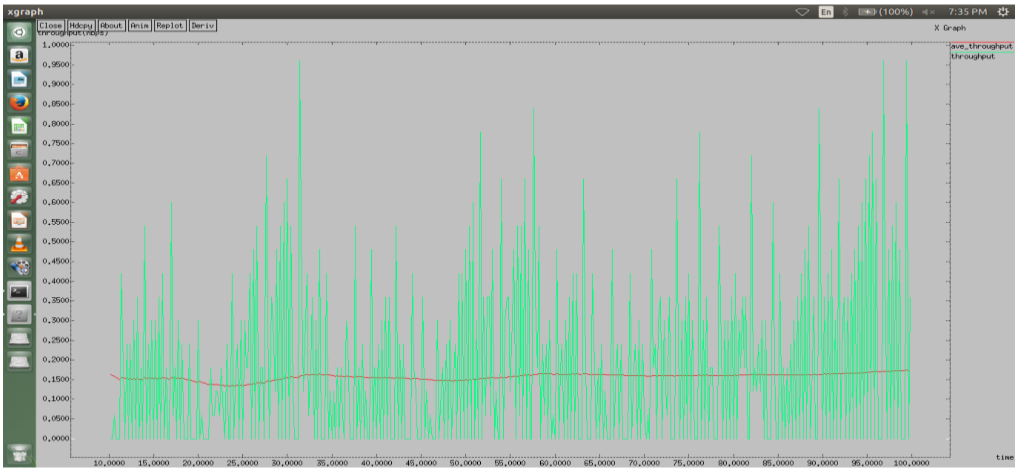

Fig 6: The performance of Conventional networks in text scenario

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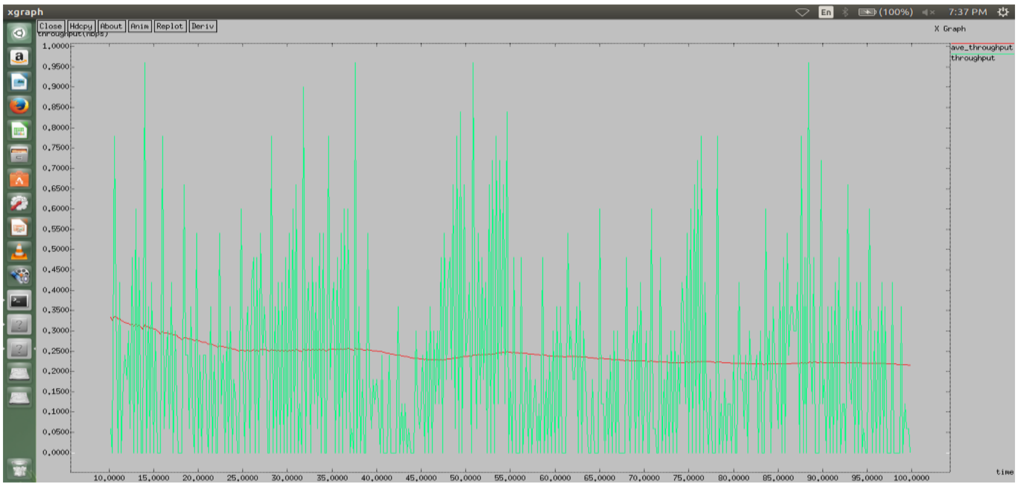

Fig 7: The performance of MPLS networks in text scenario

Table 2: Packet loss rate for conventional network and MPLS network in text scenario

Network Type	IP	MPLS
Simulation Time	20 seconds	20 seconds
Total no. of packets transmitted	7212	14343
Total no. of packets received	7112	14283
Total no. of packets dropped	100	60
Packet Loss Rate	1.38	0.41

7.Conclusion

The paper performs the analysis of conventional and MPLS network and also shows the importance of MPLS technology on voice and text scenario, Network topology and all the parameters which is necessary for simulation is same. The final results are obtained after the simulation of NS-2. The graphs clearly examine the average throughput for both the scenarios and the table indicates the behavior of packet which is obtained via trace file and hence calculates the packet loss rate. After study the all results it is clearly stated that MPLS performs better than conventional network.

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